CLAIMS

What is claimed is:

1. A Q-pole type mass spectrometer installed in reduced-pressure atmospheric gas, characterized in that the motion of ion to be measured in the axial direction advancing from an ion source to the side of a collector is controlled within a Q-pole region while the ion to be measured is subjected to mass separation by Coulomb force in the axial direction generated by quadrupole high-frequency electric field.

2. The Q-pole type mass spectrometer according to claim 1, characterized in that upon control on the motion of ion to be measured in the axial direction within the Q-pole region, after the ion to be measured is decelerated, the ion is accelerated within the Q-pole region so as to have a higher speed within a speed range in which mass separation is achieved.

3. The Q-pole type mass spectrometer according to claim 1, characterized in that upon control on the motion of ion to be measured in the axial direction within the Q-pole region, the ion to be measured is kept to sojourn within the Q-pole region and the sojourning ion is injected to the side of a collector intermittently.

4. The Q-pole type mass spectrometer according to claim 1, characterized in that upon control on the motion of ion to be measured in the axial direction within the Q-pole region, after the ion to be measured passes an entrance fringing region of the Q-pole type mass spectrometer at a speed as high as the ion does not receive any influence of fringing problem, the ion is decelerated within the Q-pole region so as to have a speed range in which mass separation is achieved.

5. The Q-pole type mass spectrometer according to claim 1, characterized in that upon control on the motion of ion to be measured in the axial direction within the Q-pole region, after the ion to be measured passes an entrance fringing region of the Q-pole type mass spectrometer at a speed as high as the ion does not receive any influence of fringing problem, the ion is kept to sojourn within the Q-pole region and the sojourning ion is injected to the side of a collector intermittently.

6. The Q-pole type mass spectrometer according to any one of claims 2 to 5,

characterized in that upon control on the motion of ion to be measured in the axial direction within the Q-pole region, Coulomb force is employed, the said Coulomb force is generated by electric field formed by four Q-poles composing the Q-pole type mass spectrometer, so constructed that four Q-poles have an equal DC potentials except DC voltage: U at the same position in the axial direction of each Q-pole of four Q-poles, while the each Q-pole of four Q-poles has different DC potentials depending on their positions in the axial direction.

7. The Q-pole type mass spectrometer according to claim 6, characterized in that a thin film is formed on part or all of the surface of four Q-poles composing the Q-pole type mass spectrometer, and the DC potential different depending on the position of the Q-pole in the axial direction or the DC potential different depending on the position of the Q-pole in the axial direction, high-frequency voltage: V, DC voltage: U are applied to the thin film.

8. The Q-pole type mass spectrometer according to any one of claims 2 to 5, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region uses a reaction force generated by a collision between the ion to be measured and the atmospheric gas.

9. The Q-pole type mass spectrometer according to claim 8, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region using a reaction force generated by a collision between the ion to be measured and the atmospheric gas is carried out by feeding the atmospheric gas from an ion source to a collector.

10. The Q-pole type mass spectrometer according to any one of claims 2 to 5, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region is carried out by setting the length of the Q-pole, kind and pressure of the atmospheric gas, potential of the ion source and potential on the axis of the Q-pole so that the ion to be measured is capable of passing the Q-pole region without receiving any additional force in the axial direction.

11. The Q-pole type mass spectrometer according to any one of claims 2 to 5, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region is carried out using Coulomb force generated by space charge formed by the ion to be measured within the Q-pole region.

12. The Q-pole type mass spectrometer according to claim 11, characterized in that potential on the axis within the Q-pole region is lower than potential on the axis in an entrance fringing region and higher than potential on the axis in an exit fringing region.

13. The Q-pole type mass spectrometer according to any one of claims 2 to 5, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region is carried out using Lorentz force generated by high-frequency magnetic field synchronous with quadrupole high-frequency electric field applied in the diameter direction.

14. The Q-pole type mass spectrometer according to any one of claims 2 to 5, characterized in that control on the motion of ion to be measured in the axial direction within the Q-pole region is carried out using electromagnetic induction force generated by a magnetic field changing in its intensity with time passage, applied in the diameter direction.